

PATENT ABSTRACTS OF JAPAN

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(54) HEAT DRYING TYPE MOISTURE METER

(57)Abstract:

PURPOSE: To shorten a time required for measuring water content by expediting drying of a sample and to improve a measuring accuracy and reproducibility in a heat-drying type moisture meter in which the sample in a sample tray is heated and dried from above.

CONSTITUTION: The heat-dry type moisture meter heats to dry a sample in a sample tray 11 from above with an infrared lamp, and expedites the heating and drying with at least the inner surface of the tray 11 formed to be hydrophilic.



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CLAIMS

[Claim(s)]

[Claim 1] It is the stoving type moisture meter characterized by the thing of the aforementioned planchet for which an internal surface at least has a hydrophilic front face in the stoving type moisture meter which carries out stoving of the sample in a planchet from the upper part, measures weight change of this sample, and came to ask for the content moisture of this sample from this weight change.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention heats a sample from the upper part, measures weight change of a sample, and relates to the stoving type moisture meter which came to ask for the moisture of a sample from the weight change concerned.

[0002]

[Description of the Prior Art] A stoving type moisture meter carries out evaporation dryness of the sample paid to the planchet with the heat of an infrared lamp from the upper part, measures the weight of a sample by the load cell, and asks for content moisture (%) from the following formulas.

[0003]

[Equation 1]

$$M = \frac{W_o - W_t}{W_o} \times 100$$

It is here and is the moisture value W_o of M:sample. : Initial sample weight W_t : Sample weight after stoving [0004]

[Problem(s) to be Solved by the Invention] As a sample, although there is a sewage sludge etc. further, the sample of such a liquid flattens the planchet after dryness, and is *****, and it is desirable adhesives, ink, various kinds of liquefied chemicals, and to make a planchet throwing away by the product made from aluminum foil etc. other than grain, such as rice and wheat. Moreover, when measuring in the drying method by heating according a sample to irradiation of infrared radiation etc., optimum dose **** and the method of extending thinly and measuring are usually common to a planchet in a sample, and it is a desirable method. That is, it is for making it dry as much as possible for a short time, without burning a sample. If it is made to dry while the sample has been in a bowlful of state, the drying time will be required about several times compared with the case where it extends thinly, moreover, although the sample front face is burning, un-arranging [that a non-dried portion remains] will produce the interior, and it will have a big bad influence on the precision and repeatability of measured value.

[0005] However, generally the planchet made from aluminum foil used from the former had bad concordance with water, and even if it extended the sample of such a liquid with the spoon etc., it inclined in the shape of a dot, and it had a problem also on the drying time or the accuracy of measurement.

[0006] The purpose of this invention is offering the stoving type moisture meter of new composition of measuring shortening of the drying time and raising the precision and repeatability of measured value moreover by extending the sample of a liquid thinly, the above-mentioned problem's being solved.

[0007]

[Means for Solving the Problem] According to this invention, stoving of the sample in a planchet is carried out from the upper part, weight change of a sample is measured, and the stoving type moisture meter characterized by the thing of a planchet for which an internal

surface has a hydrophilic front face is offered at least in the stoving type moisture meter which came to obtain the content moisture of a sample from this weight change. The planchet in this invention may fabricate and create the aluminum foil of a hydrophilic property, and with a surfactant, the internal surface of a hydrophobic planchet may be processed hydrophilic-property-ization and may be used for it.

[0008]

[Function] Since the front face of a planchet is a hydrophilic front face, a liquid sample is sufficient and it spreads, and a deer is carried out, the drying time is shortened, and, moreover, it can measure improvement in the accuracy of measurement or repeatability.

[0009]

[Example] this invention is explained in detail with reference to an attached drawing. Drawing 1 shows the cross section of the stoving type moisture meter of the example of this invention. Lower windshield 12b which surrounds the planchet 11, the pan stop 14, and planchet 11 which were carried on the pan stop 14 fixed to the upper limit of measurement pillar 15a of a load cell 15, and the pan stop 14 so that this stoving type moisture meter might be named generically by the reference number 2 of drawing 1, It is attached in up windshield 12a prepared above the pan stop 14, and up windshield 12a. The enclosed-type housing 18 which contains the load cell 15 as the infrared lamp 13 which heats the sample in a planchet 11 from the upper part, and an electronic balance, and supports up windshield 12a and lower windshield 12b, While consisting of the control sections 4 and displays 8 which were prepared in the housing 18 interior, heating the sample in a planchet 11 from the upper part by the infrared lamp 13 and evaporating sample content moisture, the weight of a sample is measured timely and it asks for content moisture from an above-mentioned formula. That is, the measured weight change value is periodically sent to a data processor 7 through an analog-to-digital converter from the calculation circuit 5, and it is sent to a control section 4 while it calculates the above-mentioned formula here and displays obtained moisture change (%) by the display 8.

[0010] The load cell 15 was fixed to the pars basilaris ossis occipitalis in the enclosed-type housing 18, and the nose of cam of measurement pillar 15a prolonged in the perpendicular direction upper part penetrated opening 18a prepared in the upper surface wall of housing 18, and has projected it above housing 18. The pan stop 14 of 3 **** is being fixed at the nose of cam of measurement pillar 15a. A reflecting plate 16 is fixed to the upper surface of housing 18 through boss 16a, and further, lower windshield 12b is being fixed to the reflecting plate 16 so that a pan stop 14 may be surrounded.

[0011] Up windshield 12a is prepared in the support (not shown) fixed to the upper surface back section of housing 18 possible [rotation], and at the time of operation of the stoving type moisture meter 2, it has consistency right above [of lower windshield 12a], and is located. Lamp socket 13a is prepared in the ceiling side of up windshield 12a, and insertion fixation of the mouthpiece of the infrared lamp 13 which is a source of up heating is carried out. A planchet 11 is put on a pan stop 14.

[0012] The operation of the above-mentioned example is explained below. The stoving type moisture meter 2 is made into operating state, the planchet 11 which does not pay the sample to is set to a pan stop 14, and up windshield 12a is arranged in the upper part of a planchet 11. After performing zero amendment (TEA) of a load cell 15, a suitable quantity of a sample is extracted to a planchet 11, and the initial mass of a sample is measured. When a sample was a liquid at this time, as shown in drawing 2, even if the planchet used from the former had the high water repellence of a planchet internal surface and it extended it with the spoon etc., it had the property to incline in the shape of a dot. It thinks because the surface tension which a sample has is larger than the adsorption power on the front face of contact of a planchet as this cause. However, in the planchet 11 with the hydrophilic front face of this invention, as shown in drawing 3, it can extend thinly easily with a spoon etc. This shows that the adsorption power on the front face of contact of a planchet 11 increased sharply.

[0013] Next, power is supplied to the infrared lamp 13 which is a source of up heating in this state, and stoving of the sample is carried out. A load cell 15 measures weight change of a

sample every moment, and outputs a measurement weight to the calculation circuit 5. Moreover, the output of the calculation circuit 5 is sent to a data processor 7, and the moisture value (%) of a sample is calculated from the above-mentioned formula here. The above operation is continuously performed until a sample is dried enough.

[0014]

[Effect of the Invention] As mentioned above, the internal surface of a planchet can be written as a hydrophilic front face, and the sample of a liquid can also extend it thinly on a planchet easily. As a result, the drying time of a sample can be shortened, and, moreover, improvement in the accuracy of measurement or repeatability can be measured. According to the experiment of the following made by the artificer, it became clear that shortening of the drying time can be sharply measured as shown in drawing 4.

[0015] As a planchet with an example of experiment 1 hydrophilic-property front face, it is Nippon Foil Mfg. Make. The 1-N30-O type (50 microns in thickness) was prepared. Generally, by the difference in a heat treatment process, as for this type of aluminum foil, a front face has few organic compounds, it is purer than the conventional aluminum foil on it, for the reason, a hydrophilic property becomes high, and the sample of a liquid spreads well. Considering [both] the planchet of this hydrophilic material, and the planchet made from the conventional aluminum foil as the same size (50 microns in thickness, diameter $\phi 120\text{mm}$, a depth of 15mm), when the evaporation dryness experiment was conducted, as shown in drawing 4, evaporation dryness was considerably promoted for the way of the planchet of a hydrophilic material.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The cross section showing the stoving type moisture meter of one example of this invention.

[Drawing 2] In drawing showing signs that the sample was paid to the conventional planchet, (a) is a plan and (b) is a cross section.

[Drawing 3] In drawing showing signs that the sample was paid to the planchet with the hydrophilic front face by this invention, (a) is a plan and (b) is a cross section.

[Drawing 4] The graph which shows the comparative-experiments result of evaporation dryness.

[Description of Notations]

2 Stoving Type Moisture Meter

4 Control Section

5 Calculation Circuit

7 Data Processor

8 Display

11 Planchet

12a Up windshield

12b Lower windshield

13 Infrared Lamp

13a Lamp socket

14 Pan Stop

15 Load Cell

15a Measurement pillar

16 Reflecting Plate

16a Boss

18 Housing

18a Opening

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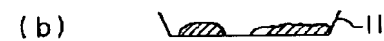
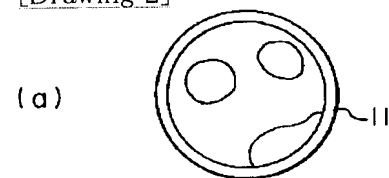
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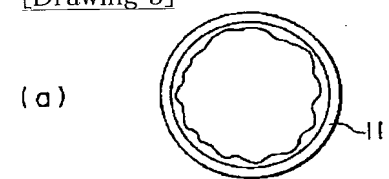
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DRAWINGS

[Drawing 2]



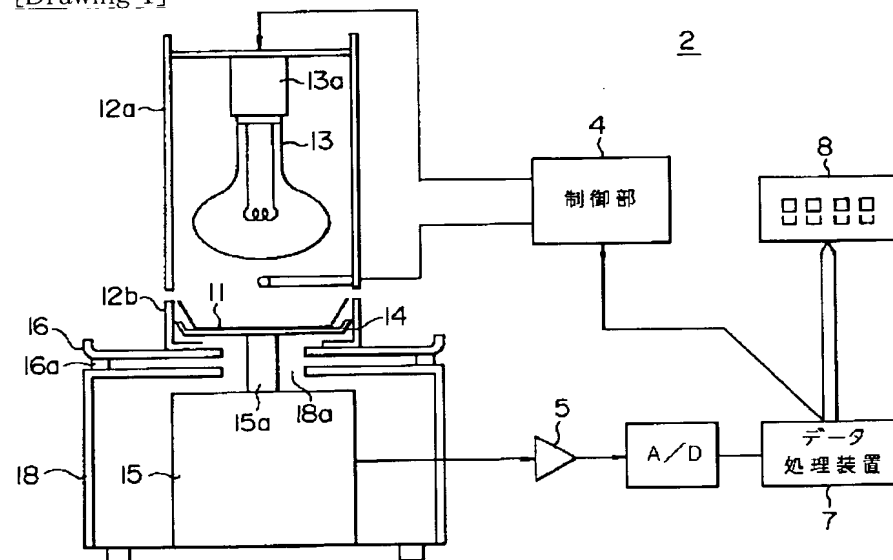
[Drawing 3]



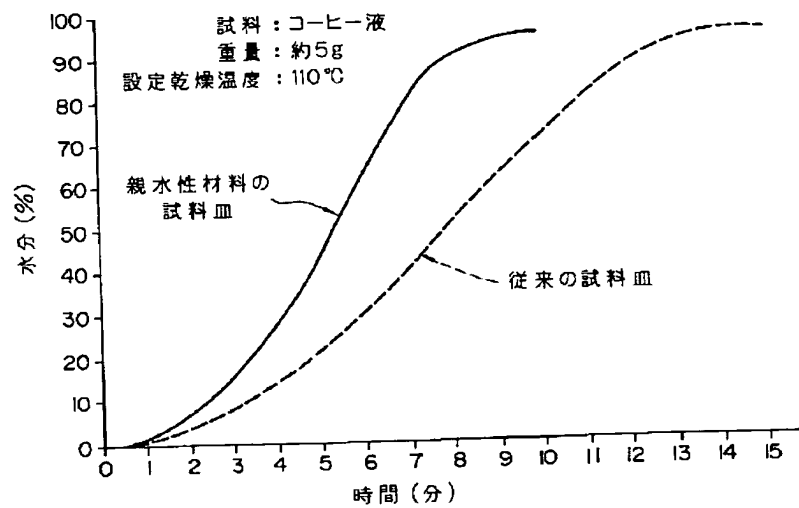
11: 試料皿



[Drawing 1]



[Drawing 4]



[Translation done.]

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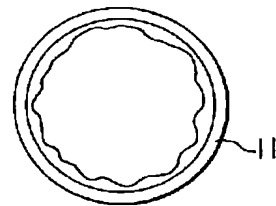
(54) 【発明の名称】 加熱乾燥型水分計

(57) 【要約】

【目的】 試料皿内の試料を上方から加熱乾燥するようにした加熱乾燥型水分計において、試料の乾燥を促進させ含水量の測定に要する時間を短縮し、しかも測定精度や再現性の向上を計る。

【構成】 試料皿11内の試料を上方から赤外線ランプ13で加熱乾燥するようにした加熱乾燥型水分計において、試料皿11の少なくとも内表面は親水性表面であるようにして加熱乾燥を促進することを特徴とする。

(a)



11: 試料皿

(b)



【特許請求の範囲】

【請求項 1】 試料皿内の試料を上方から加熱乾燥して該試料の重量変化を測定し、該重量変化から該試料の含有水分を求めるようになった加熱乾燥型水分計において、前記試料皿の少なくとも内表面は親水性表面を持つことを特徴とする加熱乾燥型水分計。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、上方から試料を加熱して試料の重量変化を測定し、当該重量変化から試料の水分を求めるようになった加熱乾燥型水分計に関する。

【0002】

【従来の技術】加熱乾燥型水分計は、試料皿にいた試料を上方から赤外線ランプの熱で蒸発乾燥させ、試料の重量を荷重計で測定し、以下の計算式から含有水分(%)を求めるようになっている。

【0003】

【数 1】

$$M = \frac{W_0 - W_1}{W_0} \times 100$$

ここで M：試料の水分値

W₀：初期試料重量

W₁：加熱乾燥後の試料重量

【0004】

【発明が解決しようとする課題】試料としては、米や麦などの穀物の他に、接着剤、インク、各種の液状薬品類、さらには下水汚泥などがあるが、このような液体状の試料は乾燥後試料皿にこびり付くので、試料皿は、アルミ箔製等で使い捨てにするのが好ましい。また、試料を赤外線等の照射による加熱乾燥法にて測定をする場合、通常は試料を試料皿に適量取り、薄く広げて測定する方法が一般的であり、好ましい方法である。すなわち、試料を焦がすことなくできるだけ短時間で乾燥させるためである。もし試料が山盛りの状態のままで乾燥させると乾燥時間は薄く広げた場合に比べて数倍程度要し、しかも試料表面は焦げているのに内部は未乾燥の部分が残ったりするという不都合が生じ、測定値の精度や再現性に大きな悪影響を与えることになる。

【0005】しかしながら、従来から用いられているアルミ箔製試料皿は一般的に水とのなじみが悪く、このような液体状の試料はスプーン等で広げても水玉状に偏ってしまい、乾燥時間や測定精度上でも問題があった。

【0006】本発明の目的は、上記問題を解決すべく、すなわち液体状の試料を薄く広げることにより乾燥時間の短縮を計り、しかも測定値の精度や再現性を向上させる新規な構成の加熱乾燥型水分計を提供することである。

【0007】

【課題を解決するための手段】本発明によれば、試料皿

内の試料を上方から加熱乾燥して試料の重量変化を測定し、この重量変化から試料の含有水分を得るようになった加熱乾燥型水分計において、試料皿の少なくとも内表面は親水性表面を持つことを特徴とする加熱乾燥型水分計が提供される。本発明における試料皿は、親水性のアルミ箔を成形して作成してもよいし、疎水性の試料皿の内表面を界面活性剤で親水性化処理して用いてもよい。

【0008】

【作用】試料皿の表面は、親水性表面であるため、液体状試料でもよく拡がり、しかして乾燥時間が短縮され、しかも測定精度や再現性の向上を計ることができる。

【0009】

【実施例】本発明を添付図を参照して詳細に説明する。図 1 は、本発明の実施例の加熱乾燥型水分計の断面図を示す。この加熱乾燥型水分計は、図 1 の参照番号 2 で総称すると、荷重計 15 の計量柱 15a の上端に固定された皿受 14、皿受 14 上に載せられた試料皿 11、皿受 14 および試料皿 11 を包囲する下部風防 12b、皿受 14 の上方に設けた上部風防 12a、上部風防 12a 内に取り付けられ、試料皿 11 内の試料を上方から加熱する赤外線ランプ 13、電子天秤としての荷重計 15 を内蔵し、かつ上部風防 12a および下部風防 12b を支持する箱形ハウジング 18 と、ハウジング 18 内部に設けられた制御部 4 および表示部 8 とで構成され、赤外線ランプ 13 で試料皿 11 内の試料を上方から加熱して試料含有水分を蒸発させるとともに、試料の重量を適時測定して上述の式から含有水分を求めるようになっている。すなわち、測定した重量変化値は、計算回路 5 からアナログ／デジタル変換器を経て、定期的にデータ処理装置 7 に送られ、ここで上記計算式を演算し、得られた水分変化(%)を表示部 8 で表示するとともに制御部 4 に送る。

【0010】箱形ハウジング 18 内の底部には、荷重計 15 が固定され、垂直方向上方に延びる計量柱 15a の先端は、ハウジング 18 の上面壁に設けた開口 18a を貫通し、ハウジング 18 の上方に突出している。計量柱 15a の先端には、三つ又状の皿受 14 が固定されている。ハウジング 18 の上面には、ボス 16a を介して反射板 16 が固定され、さらに反射板 16 には、皿受 14 を囲むように下部風防 12b が固定されている。

【0011】ハウジング 18 の上面後方に固定された支柱(図示せず)には回転可能に上部風防 12a が設けられており、加熱乾燥型水分計 2 の動作時には、下部風防 12a の直上に整合して位置するようになっている。上部風防 12a の天井面にはランプソケット 13a が設けられ、上部加熱源である赤外線ランプ 13 の口金が挿入固定されている。皿受 14 には、試料皿 11 が載せられるようになっている。

【0012】以下に上記実施例の作動について説明する。加熱乾燥型水分計 2 を動作状態とし、試料をいれて

いない試料皿 1 1 を皿受 1 4 にセットし、上部風防 1 2 a を試料皿 1 1 の上部に配置する。荷重計 1 5 の零点補正（テア）を行った後、適当量の試料を試料皿 1 1 に採取して、試料の初期重量を測定する。この時、試料が液体状の場合、従来から用いられている試料皿は試料皿内表面の撥水性が高く、図 2 に示すごとくスプーン等で払っても水玉状に偏ってしまう性質があった。この原因としては、試料の持つ表面張力が試料皿の接触表面の吸着力より大きいためと考えられる。ところが、本発明の親水性表面を持った試料皿 1 1 では、図 3 に示すごとくスプーン等で容易に薄く払うことができる。これは、試料皿 1 1 の接触表面の吸着力が大幅に増大したことを示している。

【0013】次にこの状態で上部加熱源である赤外線ランプ 1 3 に電力を供給して試料を加熱乾燥させる。荷重計 1 5 は、試料の重量変化を時々刻々と計量し、計算回路 5 に計量重量を出力する。また計算回路 5 の出力は、データ処理装置 7 に送られ、ここで前述の計算式から試料の水分値（％）が計算される。以上の動作は、試料が充分乾燥されるまで継続して行われる。

【0014】

【発明の効果】以上のように試料皿の内表面を親水性表面としたため、液体状の試料でも容易に試料皿上に薄く払うことができる。しかして、試料の乾燥時間を短縮でき、しかも測定精度や再現性の向上を計ることができる。発明者でなした以下の実験によれば、図 4 に示すように大幅に乾燥時間の短縮が計れることが判明した。

【0015】実験例 1

親水性表面を持つ試料皿として、（株）日本製箔製 1 N 3 0 - O タイプ（厚さ 5 0 ミクロン）を準備した。一般的にこのタイプのアルミ箔は、熱処理工程のちがいに 30 より従来のアルミ箔よりも表面に有機化合物が少なく、清浄であり、そのために親水性が高くなり液体状の試料*

*がよく拡がる。この親水性材料の試料皿と従来のアルミ箔製の試料皿を、ともに同一寸法（厚さ 5 0 ミクロン、直径 ϕ 1 2 0 mm、深さ 1 5 mm）として、蒸発乾燥実験を行なったところ、図 4 に示すように、親水性材料の試料皿のほうが、かなり蒸発乾燥が促進された。

【図面の簡単な説明】

【図 1】本発明の一実施例の加熱乾燥型水分計を示す断面図。

【図 2】従来の試料皿に試料を入れた様子を示す図で、（a）は平面図、（b）は断面図。

【図 3】本発明による親水性表面を持つ試料皿に試料を入れた様子を示す図で、（a）は平面図、（b）は断面図。

【図 4】蒸発乾燥の比較実験結果を示すグラフ。

【符号の説明】

2 加熱乾燥型水分計

4 制御部

5 計算回路

7 データ処理装置

20 8 表示部

1 1 試料皿

1 2 a 上部風防

1 2 b 下部風防

1 3 赤外線ランプ

1 3 a ランプソケット

1 4 皿受

1 5 荷重計

1 5 a 計量柱

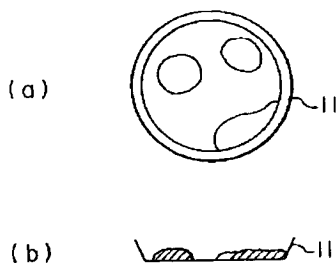
1 6 反射板

30 1 6 a ボス

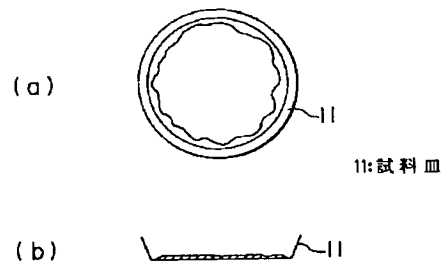
1 8 ハウジング

1 8 a 開口

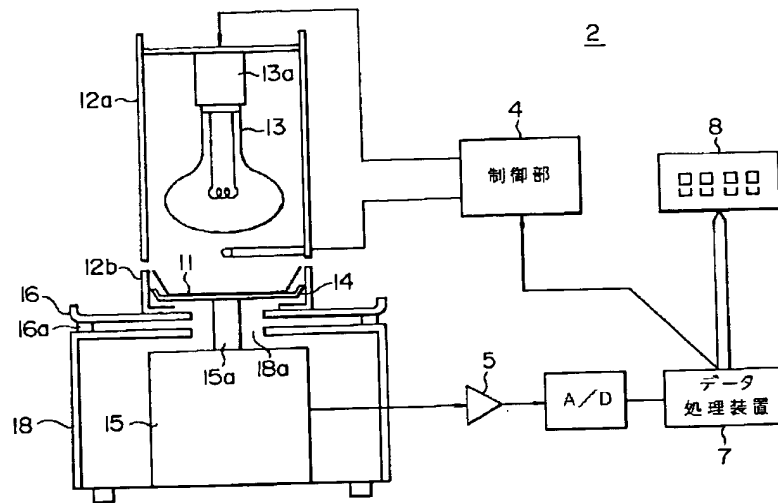
【図 2】



【図 3】



2



試料：コーヒー液
重量：約5g
設定乾燥温度：110℃

水分 (%)

時間 (分)

親水性材料の試験皿

従来の試験皿

時間 (分)	親水性材料の試験皿 (%)	従来の試験皿 (%)
0	0	0
1	2	1
2	10	3
3	20	7
4	30	12
5	45	18
6	65	25
7	85	35
8	92	45
9	96	55
10	98	65
11	-	75
12	-	85
13	-	92
14	-	96
15	-	98